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GINNING COTTON to Preserve Fiber Quality

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GINNING COTTON to Preserve Fiber Quality

By Alfred M. Pendleton¹ and Vernon P. Moore²

The Effect of Trash and Moisture on Quality Ginning

Eli Whitney invented an ingenious machine. It worked wonders in solving a vexing problem of that age—that is, how to remove the fibers from the seed of *very clean* seed cotton. By very clean, we mean that almost all foreign matter had been carefully removed by hand. Whitney's gin met a great economic need because (1) it removed cotton fibers much faster than hand methods and (2) it removed cotton fibers at much less cost than hand methods.

It did not necessarily remove the fibers more gently than hand methods. As a matter of speculation, it is highly probable that the hand-ginned fibers had fewer neps, fewer short fibers, and greater uniformity. But Eli's gin was an adequate answer to a pressing problem, so it sparked revolutionary changes in both cotton production and manufacturing. It enabled an entire industry to compete for expanded markets.

The principle of Eli's gin, when applied to absolutely clean seed cotton, is as satisfactory today as in the 1790's. But the ginning problems of today are much more complicated, so that our modern cotton gin must be equipped to perform many additional functions. It is equipped with many new machines employing several different physical principles that help remove green bolls; dry the fibers; scrub out dirt and leaf; separate out the sticks and burs; replace moisture if necessary; remove lint from seed; straighten, parallelize and smooth the fibers; and bale the lint.

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The machines to perform these functions have been developed and adapted through carefully planned research, by both private concerns and public agencies, for the purpose of providing the highest quality lint in less ginning time and at less ginning expense. Today's more expensive and more complicated gin is the industry's answer to much more complicated processing problems. The principal causes of these problems are the twin jinxes of excess trash and excess moisture due primarily to labor-saving practices employed during harvest. As mechanical harvesting has increased, ginning problems have multiplied.

Table 1 indicates that only 15 percent of the U.S. crop was gathered by hand in 1965 while 85 percent was mechanically harvested. One percent of the crop was actually picked up from the ground with salvage machines. Table 2 shows that in the same year the average machine-picked bale of seed cotton carried 85 pounds more trash and moisture than the average U.S. hand-picked bale. This same table indicates that the average machine-stripped bale carried 659 pounds more trash and moisture than even the machine-picked bale. And, machine-stripped cotton comprised one-fourth of the 1965 crop. Let us repeat then that excess moisture and trash brought to the cotton gin have created the need for more and better cotton gin machinery.

At the same time, careful research has shown that the quantity of trash is not the whole problem. For instance, we could remove 600 pounds of dry burs (hulls) from a bale of hand-snapped seed cotton very efficiently in 1940, but we could not properly remove 50 pounds of green leaf and stems with the ginning machinery available at

Table 1—Methods of Harvesting Cotton, United States, 1960–65.

Crop year	Percent hand-picked	Percent hand-snapped	Percent machine-picked	Percent machine-stripped	Percent machine-scraped
1960.....	33	16	36	15	—
1961.....	27	14	39	19	1
1962.....	20	10	48	20	2
1963.....	21	7	51	20	1
1964.....	16	6	58	19	1
1965.....	11	4	60	24	1

Source: ERS and C&MS, USDA.

Table 2—The Average Weight of Seed Cotton Required to Produce a 500-Pound Bale, United States, Crop of 1965.-

Hand-picked.....	1391 pounds.
Hand-snapped.....	1930 pounds.
Machine-picked.....	1476 pounds.
Machine-stripped.....	2135 pounds.
Machine-scraped.....	2420 pounds.

Source: ERS and C&MS, USDA.

Table 3—The Foreign Matter of Various Types Contained in Bales of Cotton Harvested by Specific Methods.

POUNDS PER BALE

Types	Machine picked	Machine stripped	Machine scrapped
Hulls.....	29	397	329
Sticks and stems.....	9	50	143
Leaf and dirt.....	43	78	398
Total.....	81	525	870

Source: U.S. Cotton Ginning Laboratories, ARS, USDA.

that time. Therefore, the rapid advance of cotton mechanization in the late 1940's made it necessary to reexamine the cotton ginning systems with especial attention to the necessity of identifying the characteristics of all types of foreign matter found in seed cotton.

Machinery had to be designed not just to remove pounds of trash, but to deal effectively with the specific types of trash that are carried in mechanically harvested seed cotton. These trash types include green bolls, hulls (or burs), sticks, stems, grass, bark, large leaf, small leaf, sand, dirt, pin trash, and motes. The whole problem of adequately removing the trash also involves properly handling that which is broken up or "manufactured" in the ginning process as well. In other words, machines had to be designed to

remove all the various types of trash and the excess moisture while still protecting those fiber properties so important to cotton quality and end use. Such machines have been designed, are in general use, and will be discussed in detail later.

To illustrate the several important trash types as they affect the ginning problem, we see in table 3 a breakdown by major types of the trash found in three typical bales which were harvested under average conditions by the three mechanical-harvesting methods. This table helps pinpoint the engineering problem of adapting mechanical cleaning methods to raw materials (seed cotton) containing such diverse types and quantities of foreign matter. Added to this are the technical problems created by field moisture.

Research shows that moisture is the most important factor affecting quality in the ginning process, but the location of that moisture within the seed cotton mass is also very important. Whether in the lint, in the seed, or in the foreign matter, moisture within the mass is constantly stabilizing and affecting both lint quality and seed quality.

Protection of cotton quality in the ginning process requires (1) an understanding of the importance of moisture and trash to ginning quality; (2) the measurement of moisture through the use of moisture meters; (3) the arrangement of conditioning and cleaning machines in the cotton gin to insure the proper types, sizes, and sequence; and (4) careful operation of these machines, including the bypasses, to treat the seed cotton only as needed to remove the excess moisture and trash in the particular load being processed.

A thorough study of the relationship of mois-

ture to cotton fiber properties reveals that ginning (removal of fiber from the seed) within the recommended moisture range of 6½ to 8 percent produces much more desirable fiber properties. If lint moisture is lower than that, it is beneficial to fiber properties to replace lost lint moisture before separating the lint from

the seed. Thus the hygroscopic nature of the raw cotton fiber is largely responsible for many of cotton's desirable consumer properties. It also affects the manner in which the cotton fiber reacts to manipulation during the ginning and spinning processes and thus greatly influences fiber damage.

Preserving Cotton Quality While Seed Cotton Awaits Ginning

Once the moisture is measured in seed cotton arriving at the gin, it is always advisable to gin the dampest loads immediately to avoid further quality loss. Early morning, dew-laden, machine-picked cotton has been observed to lose one full grade by 5 p.m. the same day by remaining unginned in the trailer. A good rule of thumb is (1) to gin all seed cotton immediately which measures 12 percent or more lint moisture, and (2) to store only that seed cotton which contains 8 percent or less lint moisture, relatively dry cottonseed, and very little green vegetative material. If the cotton falls between these ranges, it should, of course, be ginned as soon as feasible. By measuring the moisture of incoming cotton and adjusting the gin machinery, it is now possible to protect fiber quality more effectively than ever before.

Since seed cotton moisture is so important in the harvesting as well as the ginning process, cotton ginners should work with their producers to institute maximum use of the USDA cotton quality harvesting recommendations. These in-

clude specific moisture guidelines which, if followed, definitely bring higher quality cottons to the gins.

The gin yard custom of first-come first-served does not usually permit the best management of incoming trailers to secure highest overall quality. Ginners are making some headway in lining up lots of similar quality for ginning at the same time. The hundreds of expensive moisture meters purchased by ginners in the last few years now make this practice possible. And the many principles of cleaning and conditioning incorporated in the modern cotton gin make it possible to do quality ginning despite the problems created by today's labor-saving methods and rapid harvest. Since the once leisurely 4-month ginning season has been reduced to approximately 6 furious weeks, the commercial ginner is now required to do much more under more exacting conditions in much less time. The machines which enable him to perform this work successfully may be grouped into processes for more detailed study.

Modern Machines Employed in the Ginning Process

Seed cotton is subjected to three basic processes before it enters the gin stand for separation of the lint from the seed: Drying, cleaning, and extracting. These are essential to quality preservation, optimum market value, and rate of gin production.

As stated earlier, the key to preserving quality during ginning is proper moisture content of the

fiber. The higher the moisture content, the more the fibers will resist breakage when subjected to the stresses of processing. Therefore, from the standpoint of preserving spinning quality, the higher the moisture content during ginning, the more the ultimate use value of the cotton will be preserved. However, the lower the moisture content of the cotton, short of encountering

static electricity, the easier it is to separate the trash from the fiber, and the more efficient the gin cleaning machines will be.

Thus for cotton of a given foreign matter content, the lower the moisture during cleaning, the higher the grade. Since grade is one of the more important factors in setting the price for the farmer, it must be given prime consideration when designing or operating any ginning system.

The *cotton drier* was not developed to aid cleaning, but to prevent gin chokages and rough

preparation which resulted in grade reduction when ginning cotton with more than 8 percent moisture in the lint. There are several types of cotton driers on the market. The most widely used is the USDA tower type patented by C. A. Bennett in 1932 (fig. 1). The drying system consists of a fan or fans and a source of heated air which serve the twofold purpose of drying the cotton and conveying it through the drier. The drier itself is only a large exposure chamber which allows time for the heated air to react with the fiber. Most of the tower driers now on the market have 24 shelves and the heated air conveys the cotton through them at about 2,500 feet per minute, giving an exposure time of 15 to 20 seconds. Of the 5,013 gin batteries in the United States, 4,920 or 98 percent, are equipped with driers.

The *seed cotton cleaners* serve the dual purpose of first opening the cotton or breaking up large wads and, second, removing fine foreign matter such as leaf trash, sand, and dirt from the seed cotton (fig. 2). The seed cotton cleaner consists of revolving spiked drums or cylinders turning at about 400 r.p.m. These spiked cylinders convey the cotton over a series of grid rods or screens. This process agitates the cotton, allowing the fine foreign matter to fall through the screen or grid openings (fig. 3).

Most cleaners are made with either six or seven cylinders and are currently manufactured in widths of approximately 50, 72, and 96 inches, although a few are now being manufactured in wider widths. The widths among machines will vary 1 or 2 inches, according to the manufacturer. The capacity of the cleaners is about 6, 10, and 12 bales per hour for the respective widths. For gins having a capacity of above 12 to 14 bales per hour, two cleaners are installed in parallel, with each cleaning half the seed cotton under a split stream arrangement.

The cleaners may be used in or out of the air stream. It is common practice to use these cleaners as separators to remove the seed cotton from the hot air as it comes from the seed cotton drier. The cleaners may be used in either a horizontal position or inclined at an angle of about 30°. Because of plant construction considerations, they are usually installed at an angle and referred to as "inclined cleaners." When in-

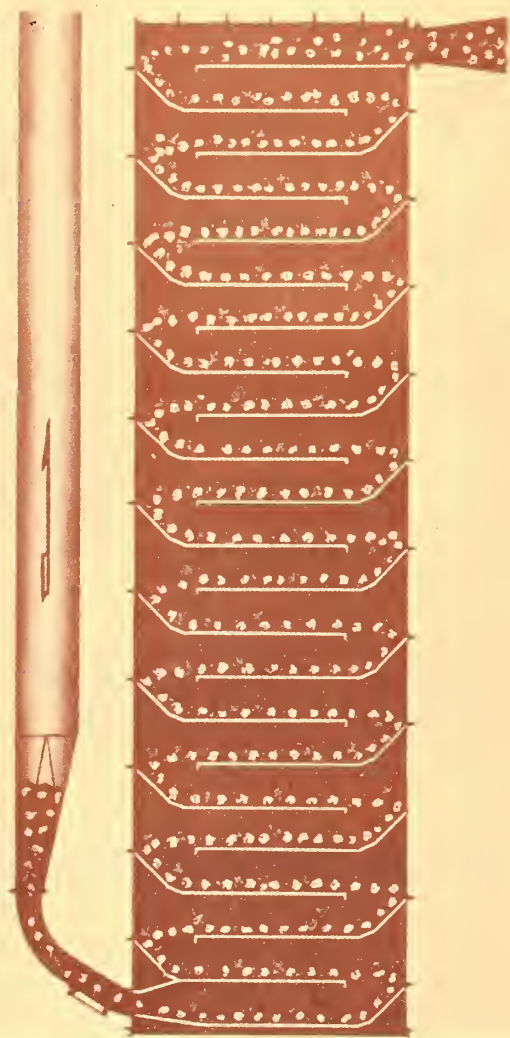


Fig. 1—The tower drier is used to remove excess moisture from the seed cotton prior to cleaning. Proper drying enables the cleaners to remove foreign matter more effectively from the seed cotton and prevents chokages in the cleaners and gin stands due to damp cotton.

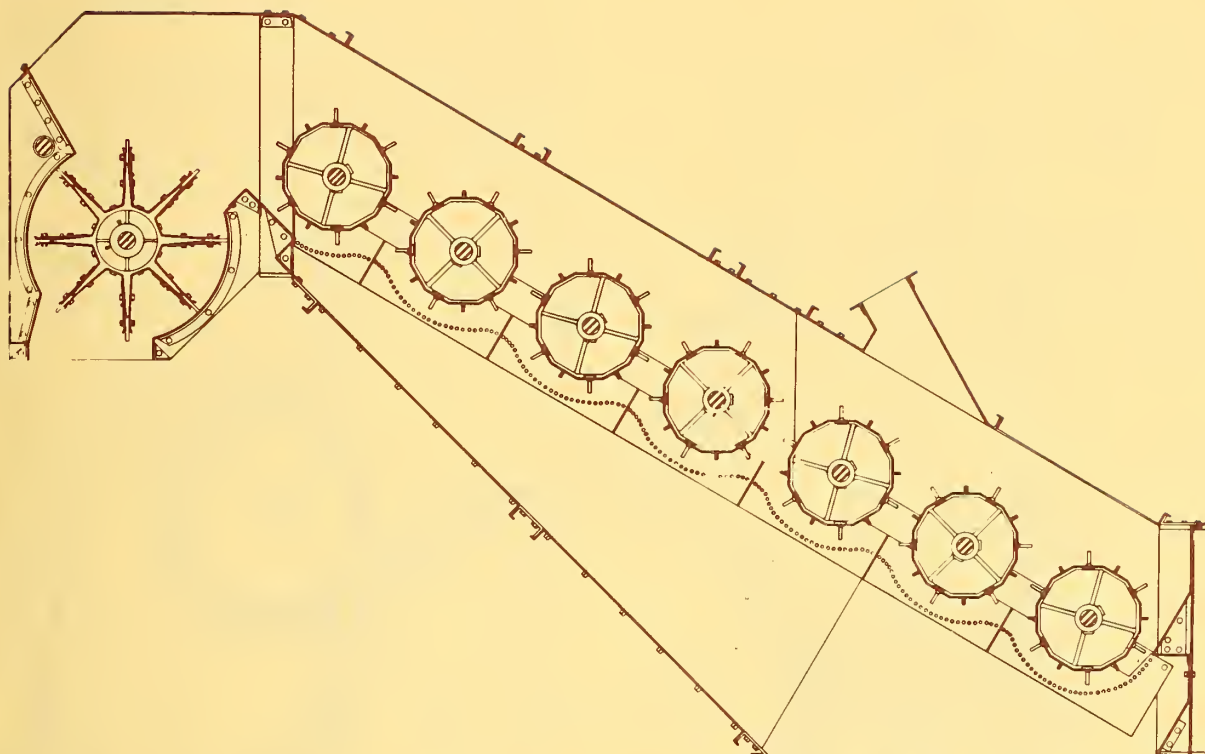
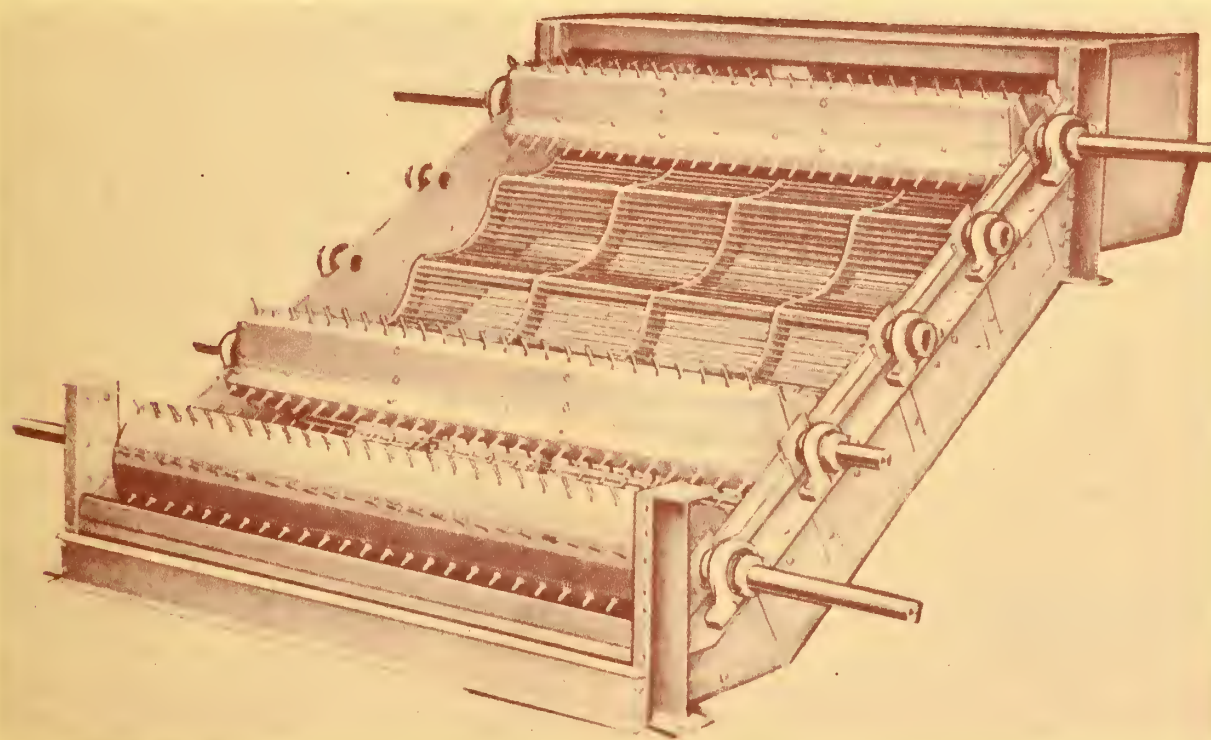
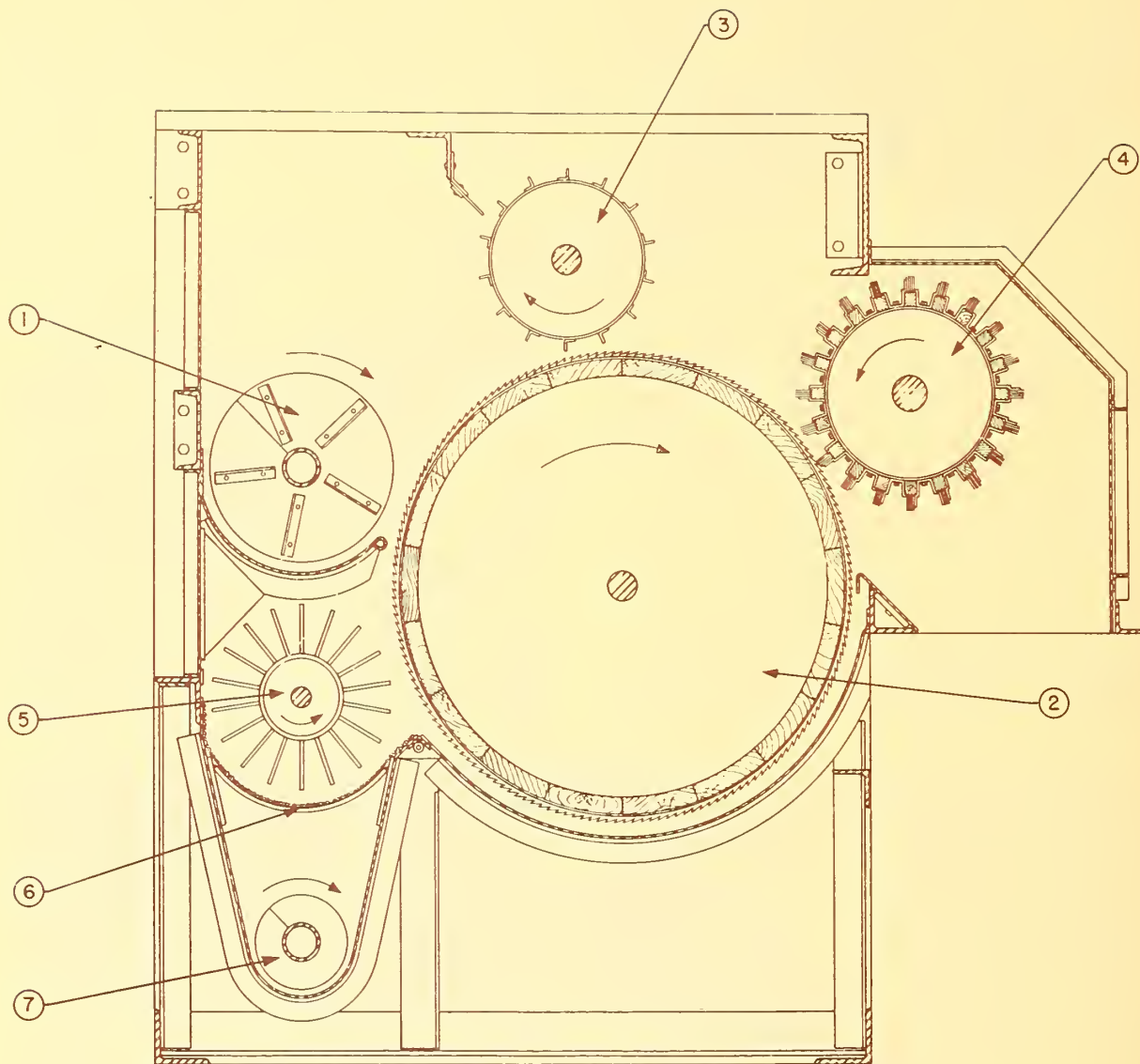


Fig. 2—The cylinder cleaner is used for the twofold purpose of breaking up wads of seed cotton and removing leaf trash and other small foreign matter. (Above.)

Fig. 3—The cylinder cleaner may be equipped with grid rods as shown here, or with a screen across which the spiked cylinders agitate the cotton to remove foreign matter. (Below.)





- 1—KICKER CONVEYOR
- 2—LARGE SAW OR EXTRACTING CYLINDER
- 3—STRIPPER ROLLER
- 4—DOFFING BRUSH
- 5—SPIKED CONVEYOR
- 6—SCREEN
- 7—TRASH CONVEYOR

Fig. 4—The bur machine is used to remove burs, sticks, stems, and other large foreign matter from roughly harvested cotton.

stalled horizontally they are called "horizontal cleaners."

The large particles of foreign matter are removed by an entirely different principle referred to as "extracting." The extracting principle, as first developed, was applied to the *bur machine* and to the *extractor-feeder*—the latter being used to clean and to meter cotton to the gin stand. The bur machine is rather large and probably more than any other machine of its day made it possible to gin hand-snapped and machine-stripped cotton. It was designed to remove sticks, burs, and other large pieces of foreign matter from seed cotton.

These machines are usually made in 10- and 14-foot lengths and are often referred to as "master bur extractors." Their capacities are relatively low in proportion to the other equipment in the gin. The capacity of the 10-foot machine will range from 5 to 10 bales per hour, and the 14-foot machine will vary from 7 to 12 bales per hour, depending upon the model.

The bur machine is relatively simple in operation (fig. 4). It consists of a conveyor (1) to distribute the cotton the length of the machine and present it to the extracting cylinder (2). The extracting cylinder is covered with teeth which grasp the cotton and convey it past the stripper roller (3) which simply knocks off material not being held by the extracting cylinder. This material which is knocked off finds its way through the incoming stream of cotton to the spiked conveyor (5), which conveys the foreign matter toward the outlet of the machine. The spiked conveyor also throws any locks of cotton which have fallen into the trash against the extracting cylinder where they are grasped by the teeth on the cylinder and conveyed back into the mainstream of cotton. The cotton is removed from the extractor cylinder by a brush (4).

This principle of cleaning, although it served the industry well, is rapidly disappearing for three reasons: (1) It is too slow for the modern high-capacity plant, (2) it is relatively inefficient by present day standards, and (3) it tends to break up trash into small pieces that must be removed by other machines.

For these reasons, the *stick and green leaf machine* was developed (fig. 5). It performs the

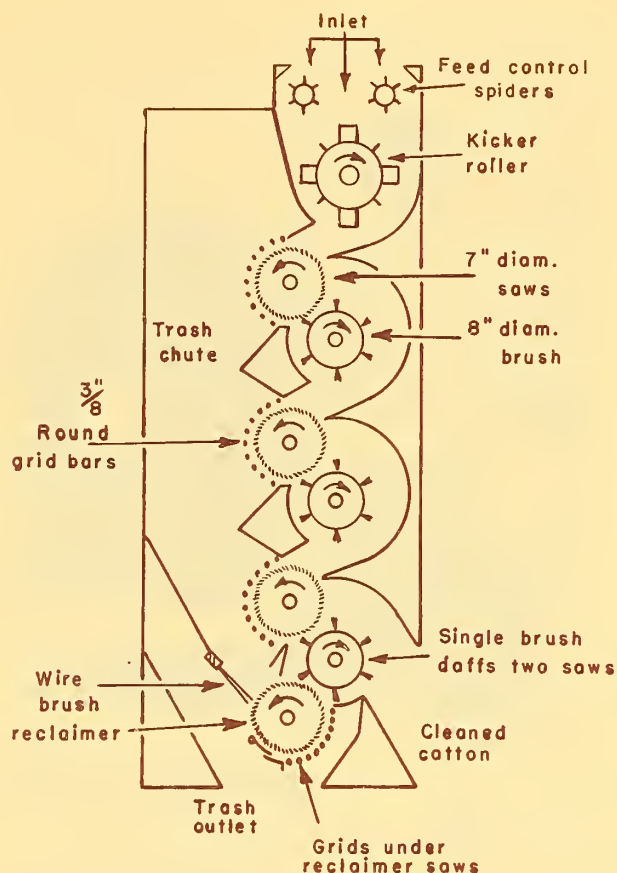


Fig. 5—The stick and green leaf machine is replacing the bur machine in all areas where cotton is not stripped. It removes sticks, stems, and other large foreign matter as well as much of the fine trash.

same functions as the bur machine, but is more efficient. It differs from the bur machine in that once the trash and cotton are separated they travel in different directions. Some commercial versions of this machine are equipped with closely spaced grid bars to aid cleaning. Others have fewer grid bars for cleaning and thus depend to a greater extent on centrifugal force to separate the foreign matter from the seed cotton which is being held firmly by saw teeth.

These machines are manufactured in about 70- and 96-inch widths. Their widths vary a few inches, depending on the manufacturer. Their capacities range from 6 to 10 bales per hour for the 70-inch machine and from 9 to 15 bales per hour for the 96-inch width. As with cleaners, when these machines are used in high-capacity

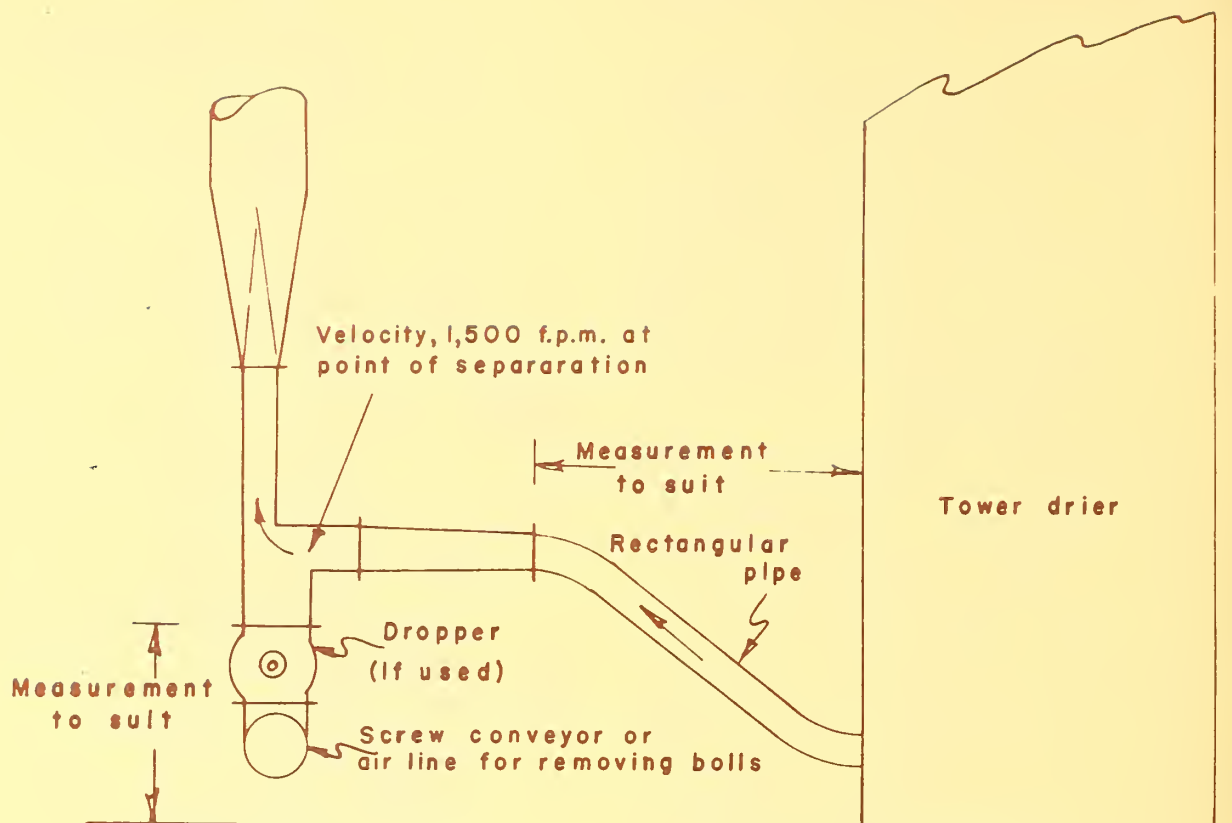


Fig. 6—A green boll trap employs the principle of reducing the velocity of the mass or abruptly changing the direction of the mass in order to remove green bolls and other heavy foreign matter from seed cotton.

plants, two of them are used in parallel in a split stream arrangement.

This extracting method is also being employed in feeders to replace the bur machine principle. Bur machines are rapidly disappearing except in areas where stripping is the predominant method of harvest.

Although the *green boll trap* is not recognized as a cleaner but as an auxiliary piece of equipment, it is an important accessory when handling roughly-harvested cotton for the removal of heavy foreign matter, including green bolls. If green bolls are allowed to enter the seed cotton cleaners, they are broken open, the lint becomes stained, and chokages are created in the cleaners and gin stands.

All green boll traps work on the principle of either reducing the air velocity or changing the direction of the flow of the mass as it is conveyed by an air stream. This allows the heavy material

to fall out of the cotton. A green boll trap designed by the USDA is shown in figure 6 and illustrates the principle employed. This particular device was installed following the tower drier so that the cotton would pass through it while spread in a thin stream. Commercial models are usually installed ahead of the drier.

The *gin stand*, which is the heart of the plant, embodies the ginning principle that has remained unchanged since invention of the gin. Essentially it consists of saws turning between the ribs (fig. 7). The saw teeth pass between the ribs at the ginning point approximately parallel to the rib face to avoid a shearing action which would cut the fibers. Cotton enters the gin stand through a huller front which performs some cleaning action (fig. 8). The saw grasps the locks of cotton, drawing them through a widely spaced set of ribs known as "huller ribs," which strip off hulls and sticks, allowing them to fall out of the machine. The locks are drawn into the roll box from the huller ribs where the removal of the fibers from the seed takes place, as described above. As the seeds are

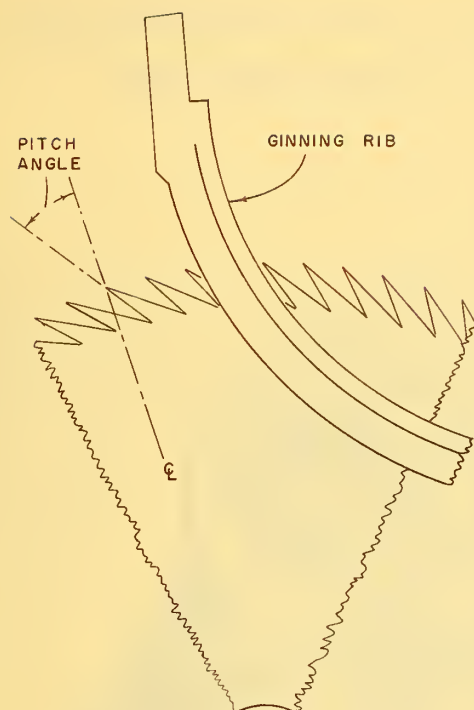


Fig. 7—The ginning rib-saw relationship at the point where ginning takes place. The fibers are carried through a slot between the ribs by the saw tooth at right angles to the face of the rib, thus avoiding a scissors action which would cut the fiber.

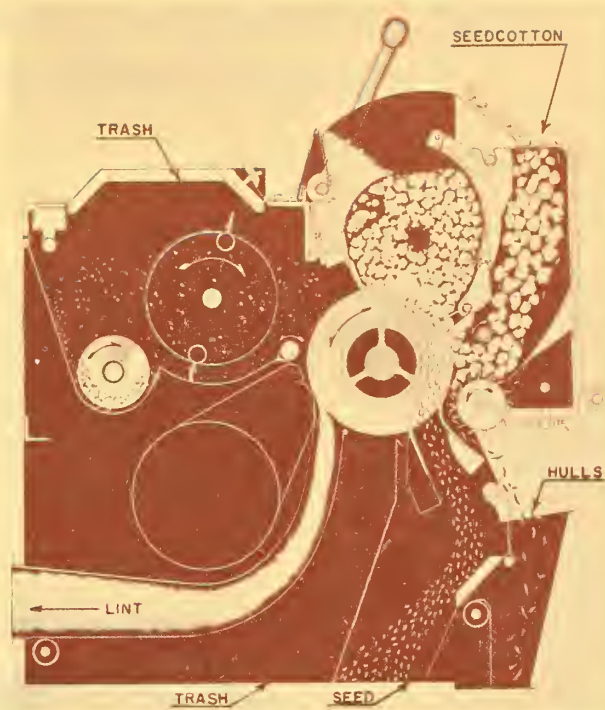


Fig. 8—The gin stand is the heart of the gin plant and is the machine which separates the lint from the seed. It is also a very efficient cleaner since it removes some hulls, sticks, stems, grass, leaf trash, and motes from the cotton.

cleaned, they slide down the face of the ginning rib and fall out the bottom of the gin stand to be conveyed away. The lint is removed from the saw by a blast of air or a brush. In this illustration, an air jet is used to blow the cotton from the saw to the lint cleaner condenser or the gin press condenser, as the case may be.

The size and capacity of the gin plant is determined by the number of gin stands it contains. Gin plants usually contain from one to five stands, with three to four being most common. One of the older model, conventional, 80-saw gin stands which were common during the 1950's could gin about one bale per hour. A later model, 90-saw gin stand with a few additional modifications could gin approximately one and one-half bales per hour. A modern, high-capacity gin stand can now gin up to six or seven bales per hour.

After the seeds are removed, the lint is conveyed by air to the *lint cleaner* for a final cleaning and combing action before baling (fig. 9).

Primarily, this machine removes leaf particles, grass, and motes (immature seeds). This fine trash removal seems to enhance the grade of machine-picked and other roughly-harvested cotton materially.

In the lint cleaning process, the fiber from the gin stand is removed from its conveying air stream by a condenser which forms the lint into a bat. This bat is then fed between directional rollers to a conventional feed plate from which it is combed or removed by the lint cleaner saw. This saw is a cylinder covered with a continuous ribbon saw and is rotating at approximately 1,000 revolutions per minute. It carries the cotton over grid bars which, aided by centrifugal force, remove the motes and foreign matter. The cleaned lint is removed from the saw by a conventional brush which also provides the air to convey it either to another lint cleaner or to the gin condenser which forms it into a bat for the bale press.

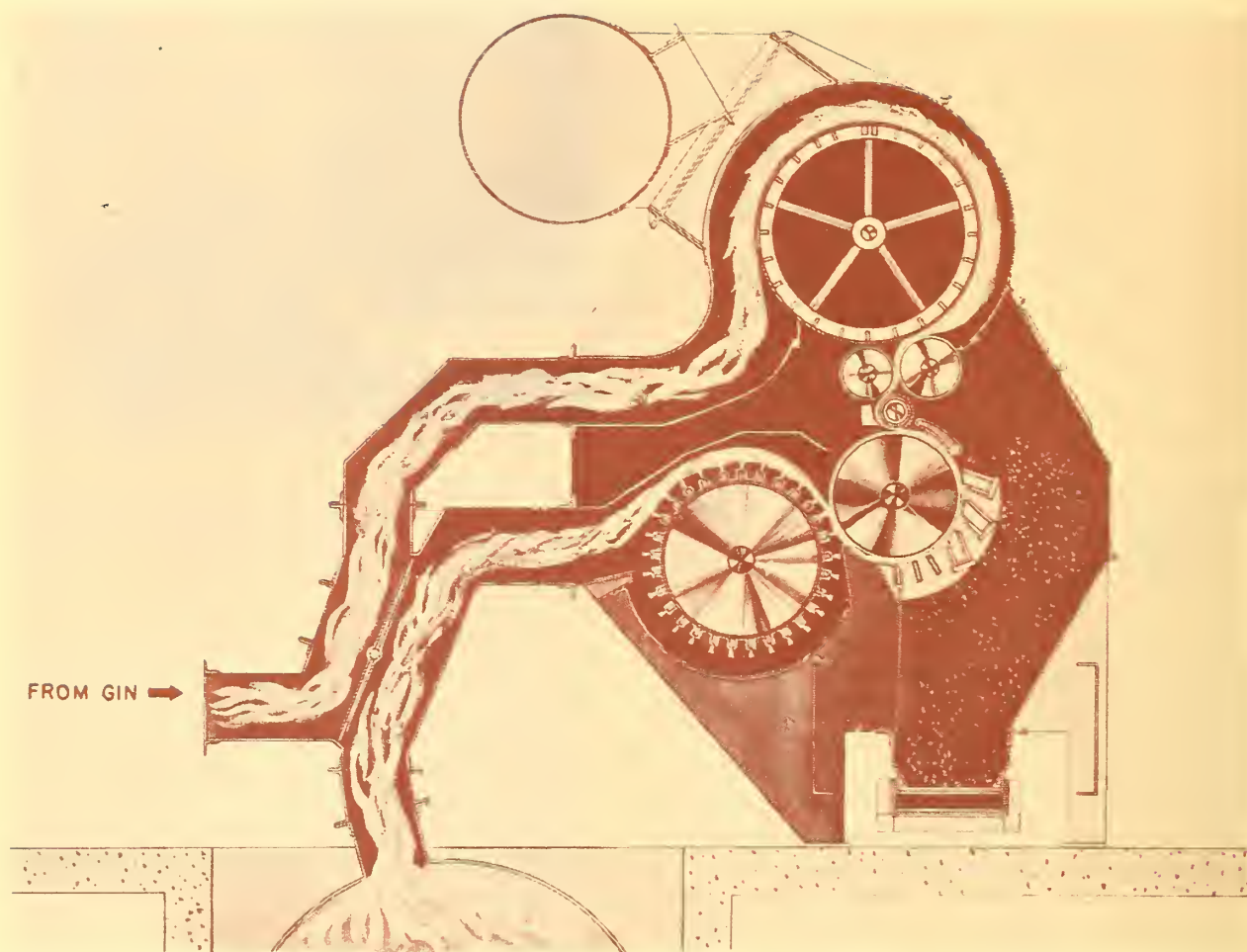


Fig. 9—The lint cleaner removes small trash and motes from the lint after ginning and before baling. It materially enhances the grade of machine-harvested and other cottons with high foreign matter content.

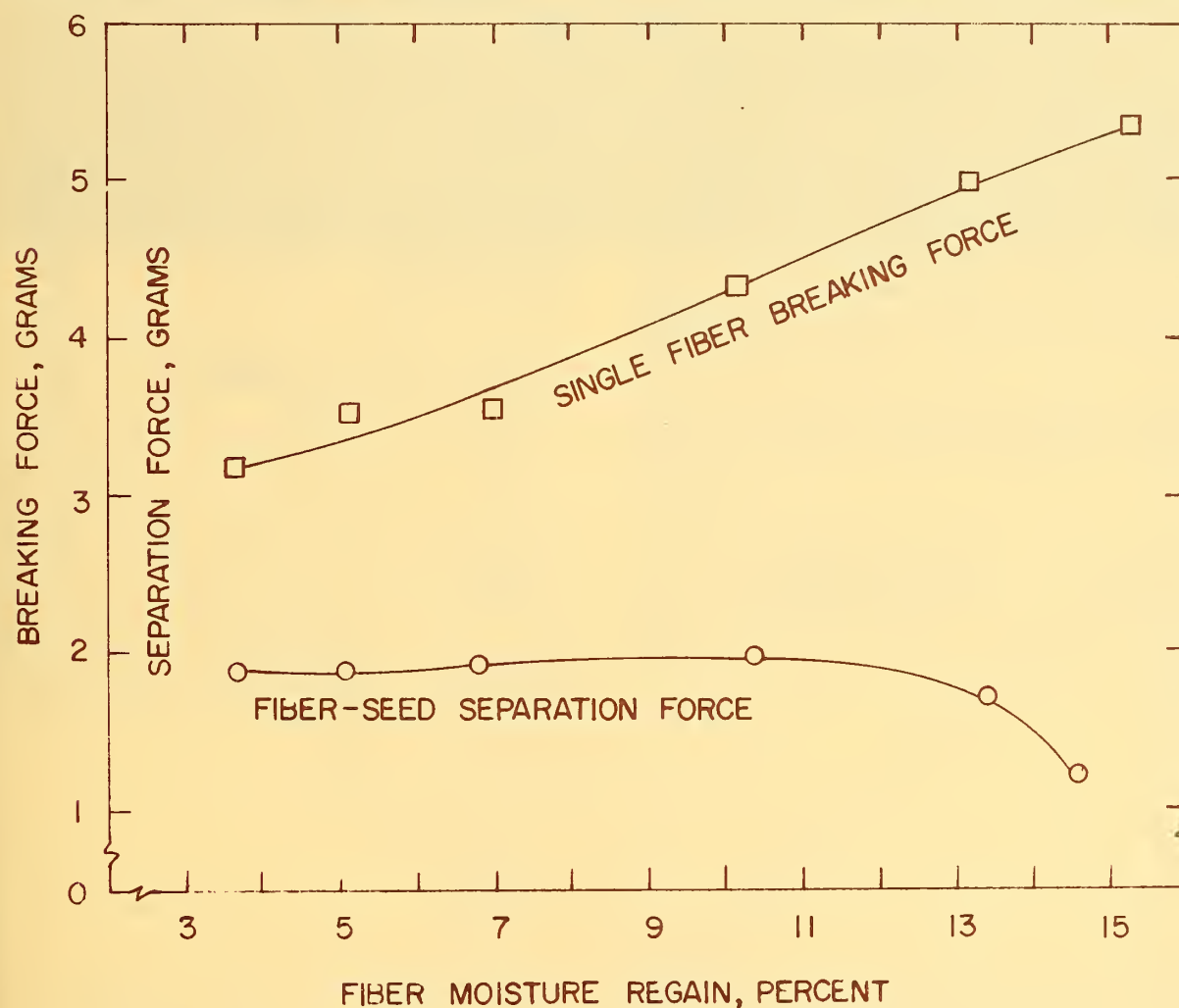
The Effect Upon Cotton of the Number, Type, and Sequence of Machines Employed

In selecting the size, number, and sequence of gin machines to install, ginners have a wide range of machinery available, as the discussion of cotton ginning equipment above has shown. The choice of certain machines, according to function, capacity, and sequence, cannot be left to chance, so research by the USDA Cotton Ginning Laboratories and by private concerns has helped to identify some of the behavior charac-

teristics of cotton fibers during the ginning process. This research has also helped to pinpoint the proper machines and sequences which can best provide quality ginning. The exact machines and sequences will be described in full later, but let us now examine some facts about the reaction of the cotton fiber to heat and to certain mechanical manipulations.

Several physical properties of cotton fibers are directly dependent upon moisture content—their shape, size, flexibility, and tensile strength,

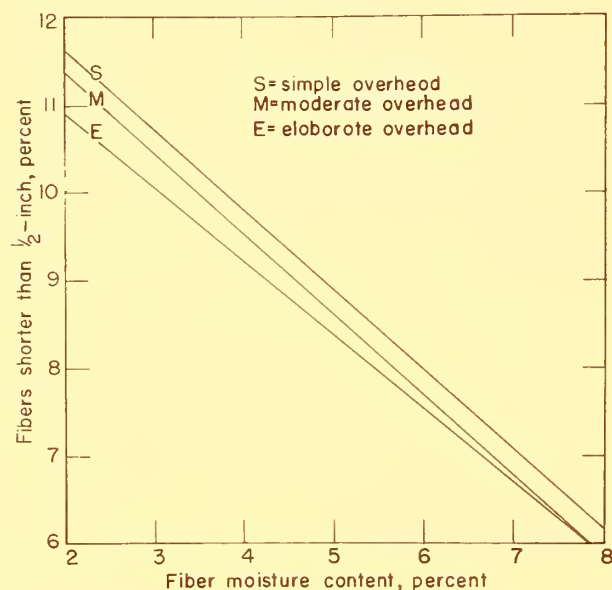
Fig. 10—The effect of fiber moisture content on single fiber breaking force and fiber seed separation force.



to name a few. Tensile strength is of special importance in ginning and, to a lesser extent, so are flexibility or rigidity. The relationship between fiber moisture and tensile strength is well known. Recent work at the USDA Cotton Ginning Laboratories has shown that while the tensile strength of raw cotton fibers increases with increasing moisture content, the force required to separate fibers from their seeds does not increase and may even decrease under certain conditions (fig. 10). This partially explains why cotton ginned at 6½ to 8 percent lint moisture will have fewer fibers broken in ginning than similar fibers ginned at lower moisture levels. Furthermore, the higher moisture range will yield fibers of greater overall length, greater uniformity, and greater strength, all of which are vitally important to spinners. This further indicates that it is a good practice to add moisture to very dry cotton prior to striking the fibers with the gin saw.

Figure 11 further shows moisture is more important to fiber quality (measured here as short fibers) than is the amount of overhead cleaning. In this case, two lint cleaners were combined with simple, moderate, and elaborate overhead machinery. The increase in short fibers created by one overhead system over the other

Fig. 11—The effect of seed cotton cleaning equipment and moisture on short fiber content.



was very minor compared to the great number created by the low moisture content.

Figure 12 shows results of research by the USDA to determine the amount of short fibers created by one or two lint cleaners as compared

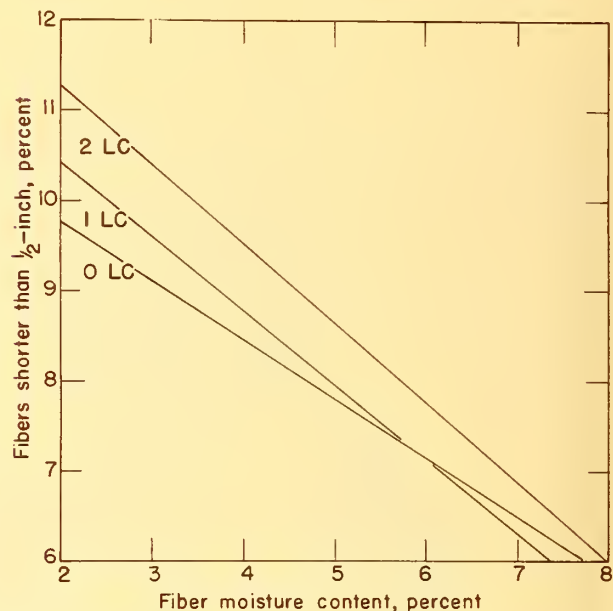
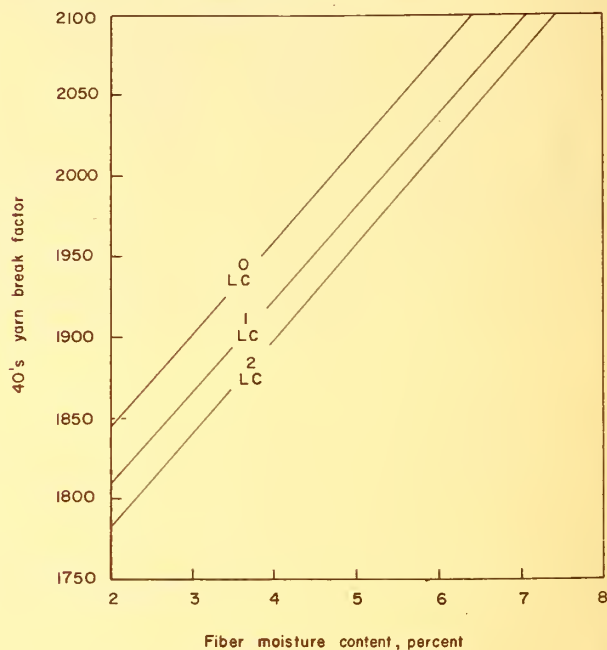


Fig. 12—The effect of lint cleaners and fiber moisture on short fiber content.

Fig. 13—The effect of lint cleaners and fiber moisture content on the break factor of 40's yarn.



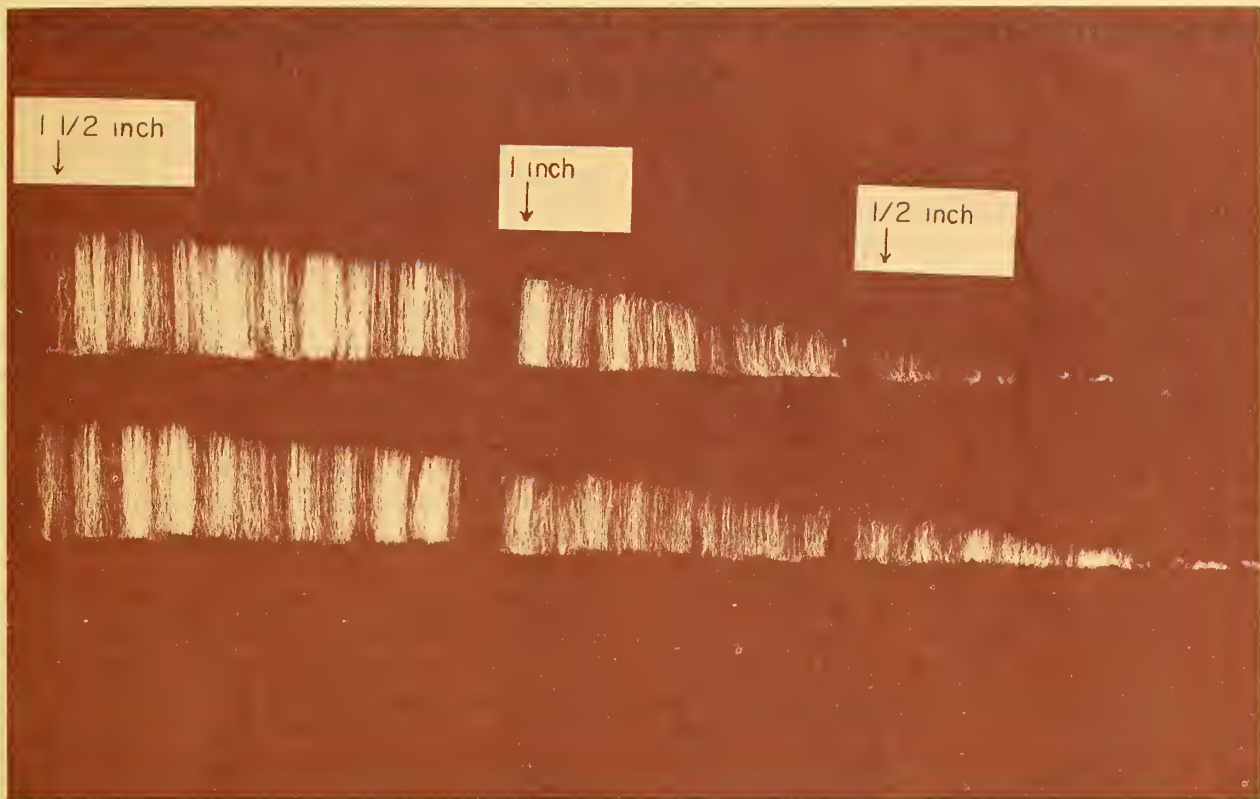


Fig. 14—Fiber arrays made from similar cottons ginned under extreme differences in moisture content and quantity of machinery. Note the difference in quantity of fibers shorter than $\frac{1}{2}$ -inch.

to low lint moisture. Again, the increase due to lack of moisture in the lint is infinitely greater than that due to two lint cleaners.

When the fiber damage caused by low moisture combined with the use of two lint cleaners is reflected in terms of the 40's yarn break factor, the greater damage again is caused by too great moisture removal (fig. 13).

Figure 14 shows the difference in fiber lengths from two arrays representing cotton fibers

ginned under extreme opposite conditions of moisture and quantity of machinery. The difference in value, to the spinner, of these two samples would range from \$12 to \$20 per bale, depending upon the end use. Many spinners would not buy the damaged sample if they discovered it.

These then are some of the ways gin machinery affects the spinnability and end use of cotton. The amount of machinery recommended, therefore, must depend upon this and other research so that the producer can be properly served at the gin and the cotton's use value likewise preserved.

Recommended Machines and Practices for Quality Ginning

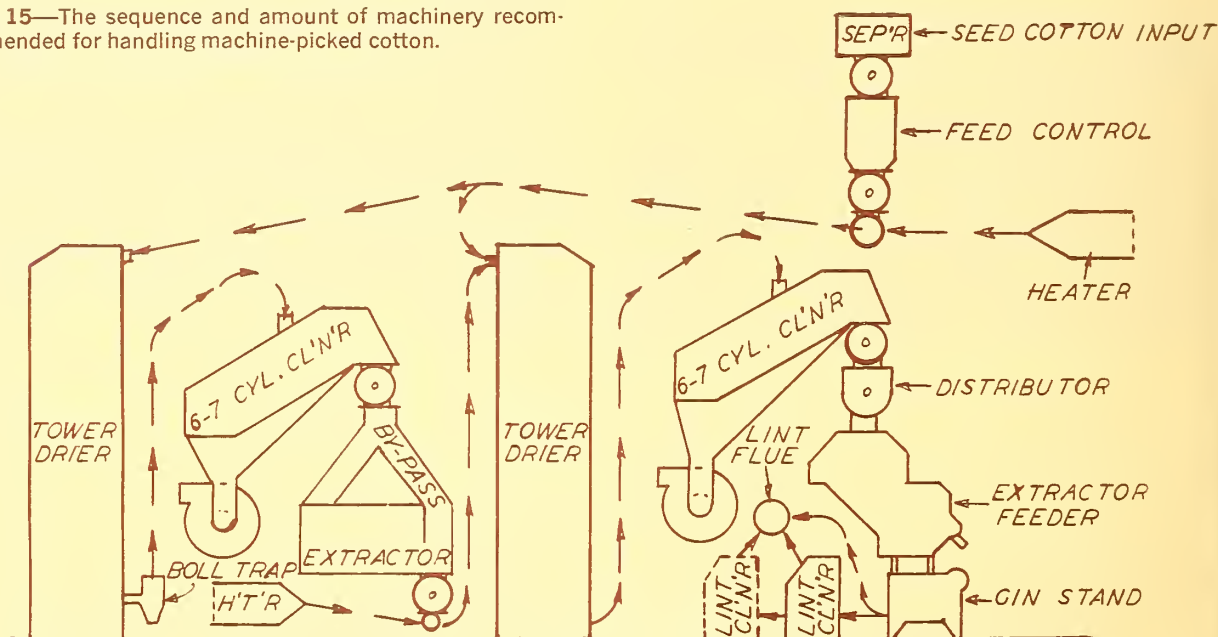
Tests at the USDA Cotton Ginning Laboratories, conducted for more than 30 years, have formed the basis for recommendations to provide the most desirable ginning systems in all Cotton Belt States. For the handling of clean, hand-picked cottons, the following machines and sequences are adequate—green boll trap, automatic feed control, drier, seven-cylinder cleaner, bur extractor or stick and green leaf machine, seven-cylinder cleaner, extractor-feeder, gin stand, and one saw-type lint cleaner. The lint cleaner can usually be bypassed during the early part of the season. Obviously, any machinery which is not necessary for the particular lot of cotton should be bypassed.

A much more elaborate gin for machine-picked cotton is necessary to obtain acceptable grades and returns for the producer while preserving quality for the spinner. For the rain-grown area, the machinery recommendations are a green boll trap, automatic feed control, 19- to 24-shelf tower drier or its equivalent,

seven-cylinder cleaner, stick and green leaf machine or bur extractor, a second full size tower drier or its equivalent, a second seven-cylinder cleaner, large extractor-feeders, gin stands, saw-type lint cleaner, and, finally, the second lint cleaner (fig. 15). The above machines are to be fitted with bypasses to allow selection of less drying, cleaning, and lint cleaning when extra clean, dry cotton is brought to the gin. In the irrigated areas, certain varieties have better cleaning characteristics which often allow use of only one lint cleaner to produce satisfactory quality.

Figure 16 shows the number and sequence of machines recommended for machine-stripped cotton. These are the same basic machines recommended for machine-picked cotton with two additions. One of these is the use of both the bur machine and the stick and green leaf machine to extract adequately the large quantity of hulls and sticks. Refer to tables 2 and 3 (page 4). The other is the airline cleaner which is some-

Fig. 15—The sequence and amount of machinery recommended for handling machine-picked cotton.



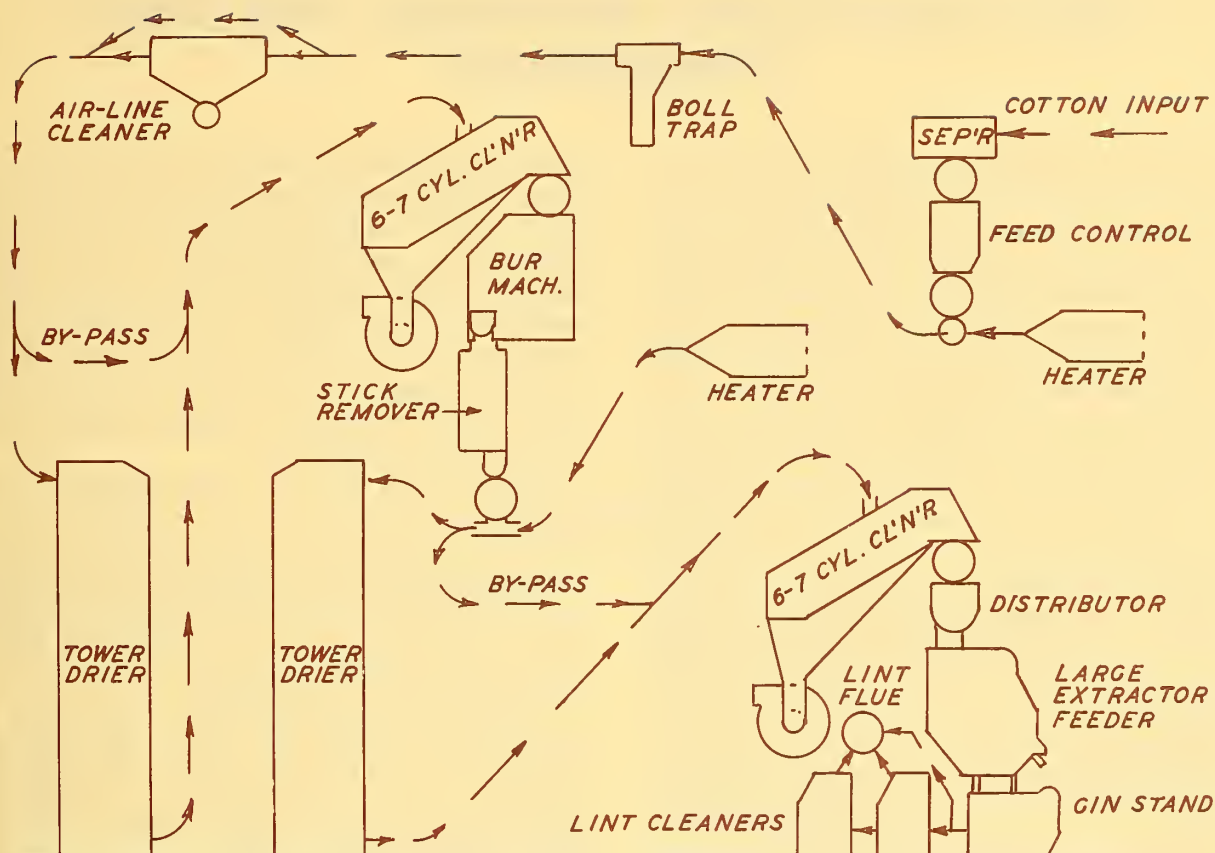


Fig. 16—The sequence and amount of machinery recommended for handling machine-stripped cotton.

times added to remove large quantities of sand and, at times, to open up bolls that have little or no lint exposed.

In areas where soft green bolls and very damp vegetative matter are brought to the gin in machine-stripped cotton, the airline cleaner has been omitted to prevent breaking apart the moist vegetative matter and green bolls. In some in-

stances, a stick and green leaf machine has been successfully used immediately behind the number one drier to throw out the green material as early as possible.

It should be repeated that each time cotton is manipulated by mechanical action it suffers slight fiber damage. No unnecessary handling of cotton should be practiced at any gin. Therefore, bypasses should be installed and used to provide only the handling necessary.

High Capacity Gins, Automation, and Other Developments

All the information presented thus far has dealt with ginning for quality—the source of research information and its application to practical commercial ginning. This research information has been carefully presented through the years by the USDA Cotton Ginning Laboratories and widely disseminated to cotton ginners by the Cooperative Agricultural Extension Service. Most of the gins built or remodeled in the last several years have followed these guidelines. The manufacturers of cotton ginning equipment have cooperated closely with the USDA in seeking to discover the principles and build the machines which make our modern gins so efficient. The majority of the cotton gins currently operating are now capable of properly handling machine-harvested cottons while protecting fiber quality.

However, the increased use of harvesting machines in recent years demands greater capacity of all cotton gins. It is now necessary to gin the crop much more rapidly so that with the harvesting machines the best use can be made of labor and weather opportunities. Therefore, most of the replacements in equipment in today's gin are primarily intended to increase ginning capacity.

Many gins being built have a capacity of 15 bales per hour per battery of stands. A few have capacities of 25 bales per hour or more. These

newer gins usually have many labor-saving devices such as partially automated presses, electrical control panels for gin stands, and cotton valves. High capacity gin stands secure their capacity primarily from the use of more saws per stand or the increase in saw diameter. The end is not yet in sight for increasing gin stand capacity. Further use of these principles and other design changes will make available gins of even greater capacity.

The new gins are also often equipped with trash collecting devices, such as high efficiency cyclones, screen cages, and in-line filters—all designed to reduce air pollution at gins. In addition, most of the new gins are arranged to provide maximum light and accessibility to work areas and safety for employees.

These newer gins may cost upward of a quarter million dollars per battery, but they are capable of quality processing that was impossible only a few years ago. Expected improvements include more electronic control equipment, cheaper materials handling systems, better bale pressing devices, and greater efficiency in all operations. In the meantime, the cotton ginning equipment being built today is tailor-made for the rugged and rapid ginning job required by mechanization. The Nation's gins are better equipped today than ever before in the long history of the cotton industry.

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